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End-to-End Validation of Topex/Poseidon Flight Procedures

ABSTRACT:

As satellites become more complex and sophisticated, the task of validating their operational ground systems becomes increasingly challenging. 10 effectively exercise system to satellite interlaces prior to launch, ground tests must closely emulate those conditions expected in flight. With this objective in mind, the 1 opex/Poseidon operations team developed and implemented a unique series of interface tests between the Payload Operations Control Center (I'OCC) at the Jet f'repulsion l aboratory (JPL) and the satellite during system integration. 1 his process validated key elements of the Mission Planning, Navigation, F light Control, and Satellite Performance Analysis 1 earns on an end-to-end basis, and was a major factor in the overall mission success currently demonstrated by 1 opex/F'oseidon.

In general, ground system to satellite interfaces are functionally verified via a spacecraft compatibility test. This test is a defined subset of the full array of functions which will eventually be required after launch. A separate ground support system is used to implement all other command sets and procedures required to verify satellite performance. During these exercises, satellite and sensor memory loads/dumps are often generated in a test format, and are not indicative of actual hardware function. Procedures used may also require extensive modification to be applicable to on-orbit operations.

1 he 1 opex/Poseidon operations team decided that in addition to a standard compatibility test, an enhanced end-to-end test program would substantially reduce risk during early orbit and normal mission phases. 1 his decision was driven by the fact that an entirely new POCC was being constructed at JPL for 1 opex/Poseidon, with requirements for realtime telemetry and near-realtime commanding to/from remote users.

Management of the end-to-end test effort began in earnest about 18 months prior to launch, and culminated with two large scale exercises termed as "Mission Operations Design and Verification Tests" (MODVTs). These tests conclusively demonstrated that an adequate operations design was in place, and that major ground system components could be expected to support all mission phases with a high probability y for success. Following the August 1992 launch of 1 opex/F'oseidon, the operations team has maintained a command error rate of near zero, largely due to experiences and lessons learned from the MODVTs.

An overall benefit to other satellite programs can be realized from the planning and implementation processes followed on Topex/Poseidon. Schedules, requirements, data flow sheets, and trade-off considerations can serve to clarify the scope and manpower required for end-to-end tests during satellite integration, and the value of such an effort. If a desire for enhanced end-to-end testing is recognized early in a program, schedule and budget impacts can be minimized.